

Landscape and well-being: a scoping study on the health-promoting impact of outdoor environments

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Abstract

Objectives The present literature review conceptualises landscape as a health resource that promotes physical, mental, and social well-being. Different health-promoting landscape characteristics are discussed.

Methods This article is based on a scoping study which represents a special kind of qualitative literature review. Over 120 studies have been reviewed in a five-step-procedure, resulting in a heuristic device.

Results A set of meaningful pathways that link landscape and health have been identified. Landscapes have the potential to promote mental well-being through attention restoration, stress reduction, and the evocation of positive emotions; physical well-being through the promotion of physical activity in daily life as well as leisure time and through walkable environments; and social well-being through social integration, social engagement and participation, and through social support and security.

Conclusion This scoping study allows us to systematically describe the potential of landscape as a resource for physical, mental and social well-being. A heuristic framework is presented that can be applied in future studies, facilitating systematic and focused research approaches and informing practical public health interventions.

Keywords Landscape · Well-being · Health-promoting behaviour · Resources · Scoping study

Introduction

An appealing landscape contributes to people's health. From a health promotion perspective, this popular and general statement about landscape provokes a number of questions on the more specific links between outdoor environments and health. One might ask how landscape can promote health in its different dimensions, i.e. physical, mental, and social well-being? How should landscapes look like to promote people's health? And who might benefit from a health-promoting landscape? There are three major challenges in addressing these questions.

First, "landscape" as an analytical term is difficult to define. The European Landscape Convention (Council of Europe 2000) currently defines landscape as 'a zone or area as perceived by local people or visitors, whose visual features and character are the result of the action of natural and/or cultural (that is, human) factors' (Art. 1). According to the CE's convention, landscape develops in a procedural manner through the interaction between nature and human beings. This is clearly different from former landscape definitions which were influenced by a strong nature/culture dualism and an environmental determinism (Ingold 1992). Furthermore, landscape can be imagined as a continuum between "wild" nature and designed environment such as urban and rural forests, green spaces, parks, gardens, waters, and neighbourhood areas.

Second, in relation to health and well-being, open questions remain concerning pathways of conscious perception of the environment: How is landscape perceived, experienced and used as a resource for healthy behaviour? Empirical as well as theoretical work suggests that landscape is linked to a dual perception. On one hand, landscape is experienced physically in a multisensory manner, in particular through sight, hearing, touching, and

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smelling: Landscape, from this perspective, is a conglomerate of different types of “scapes”, such as soundscape (Adams et al. 2006; Atkinson 2007; Carles et al. 1999; Ge and Hokao 2005; Gidlöf-Gunnarsson and Öhrström 2007; O’Connor 2008; Raimbault and Dubois 2005; Yang and Kang 2005) and smellscape (Porteous 1990). On the other hand, landscape is also a matter of individuals’ perceptions and trajectories: this means that landscape as an analytical concept is characterised by an inherently dialectical relationship between physical reality and metaphoric and social construction. The same landscape can, from this point of view, be perceived completely different. The explanation for this lies in the fact that landscape is linked to meaning, identity, attachment, belonging, memory, and history (Augenstein 2002; Davenport and Anderson 2005; Frumkin 2003; Oreszczyn and Lane 2000; Parsons and Daniel 2002; Rishbeth and Finney 2006).

Third, although a relatively large body of multidisciplinary evidence exists about the health-promoting impact of landscape in industrialised countries (St Leger 2003; Maller et al. 2006), current evidence seems too scattered to draw any specific or sound conclusions. The challenges of a literature review are the lack of consistent definitions and systematic concepts in this research field. With a methodological approach called “scoping study”, we aim at overcoming these challenges and to map out criteria for landscape as a resource for better health and well-being.

The scoping study presented in this paper is characterised by its resource-oriented perspective on the links between landscape and health. It is focused on human perceptions and behaviours related to different characteristics of landscapes and does not include studies on environmental risks for health. To our knowledge, no such focused review is available today. Current literature reviews on landscape and health focus either on the links between “wild” nature and health (Frumkin 2001; Health Council of the Netherlands 2004; Maller et al. 2006) or between the built environment and health (Jackson 2003). Our main interest, however, lies on the spaces of landscape which are situated between “wild” nature and built environment.

Against this background, this paper first provides a scoping study of publications on the health-promoting influence of landscape. Second, drawing on this overview, we propose a new heuristic framework to link landscape and health in a way that is amenable to health promotion research and practice. The current findings illustrate how the three dimensions of health—physical, mental and social well-being—are promoted through designed, constructional, and aesthetic aspects of landscape. The results of this study might be used as a basis for specific research projects and interventions that address landscape as a health resource.

Methods

As a particular method in qualitative literature reviews, scoping studies have distinct characteristics (Arksey and O’Malley 2005; Badger et al. 2000). Unlike systematic reviews, they address broader topics and topic areas, in which many different study designs might be applicable (Arksey and O’Malley 2005). This approach was suitable to identify the relevant and often non-standardised pieces of evidence of the health-promoting effects of landscape. Table 1 displays the major characteristics that were followed in the present study:

Five steps were involved in collection, evaluation, and presentation of the literature. First, we defined the research focus as well as specific inclusion and exclusion criteria for the literature search. By focusing on the links between landscape and physical, mental and social well-being, we included all literature presenting theoretical or empirical approaches on a health-promoting impact of landscape. We only included studies from industrialised countries and excluded all literature focused on environmental hazards (noise, air pollution, etc.) and their pathogenetic impact, as well as studies on agricultural use of landscape which are related to food, foodscapes, and material well-being. Foodscapes have been excluded here because they refer primarily to the distribution of commodities. As such they are directly linked to retail mechanisms and market structures which make them distinctly different from our conception of landscapes.

Table 1 Characteristics of scoping studies according to Arksey and O’Malley (2005)

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- Identification of all relevant literature regardless of methods and study designs applied
 - Non-linear, iterative, and reflexive process
 - No quality assessments of studies reviewed
 - Presenting account of existing literature with an analytic framework or thematic construction
 - 5-step framework
1. Definition of research focus, inclusion and exclusion criteria for the literature search
 2. Identification of all relevant studies, literature reviews and reports in electronic databases, key journals, reference lists of earlier studies, and topic-related expert networks and organisations with selected key words
 3. Selection of literature to be closely reviewed in a comparative and consensus orientated team process, determination of further inclusion and exclusion criteria
 4. Full-text reading and charting of literature in a descriptive-analytical way
 5. Collation, summary, structuring and report of reviewed literature
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Second, all relevant original studies and literature reviews from peer-reviewed journals and scientific reports were identified in the following sources:

- electronic databases (Web of Science, Pub Med, central online catalogue of the Swiss university libraries);
- single key journals relevant in areas that relate to landscape and health promotion;
- reference lists of earlier studies;
- topic-related expert networks and relevant organisations.

Keywords for the literature search were selected from two broad areas: landscape and health. For landscape, keywords such as landscape, healthy environment, healthy place, nature, city, urban, rural, wood, forest, park and garden were used; for health, keywords such as health, well-being, quality of life, restoration, stress recovery, mental health, physical activity, social capital and social support were used as search terms. All possible two-word combinations of single terms from both areas were employed.

In total, we found about 500 studies, reviews and reports related to our research focus. All studies were collected and systematised using a bibliography-managing software (EndNote®).

In the third step, the literature to be closely reviewed was selected by two members of the research team (AA, KS) in a comparative and consensus orientated process. The limitations in research resources required us to select only the most relevant items. Thus, further exclusion criteria were applied: Studies that focus on isolated elements of landscape like single buildings, functions of buildings, indoor environments, and those that address the therapeutic impact of certain landscape aspects in health care settings were excluded. Yet, studies focusing on built environment in terms of public places such as meeting points or streets were included. We further excluded the literature that was published before 1995 except basic literature reviews. At the end of this step, 123 studies, reviews and reports remained for full-text reading and for inclusion in the review.

In the fourth step, the data were charted. According to Arksey and O'Malley (2005), charting 'describes a technique for synthesising and interpreting qualitative data by sifting, charting and sorting material according to key issues and themes [...]'. This methodical step was conducted in a descriptive-analytical way. For this purpose, the literature was analysed and sorted according to each study's key results and design (see Table 2 for an extract of the reviewed studies). Following the principles of a scoping study, no systematic assessment of the quality of evidence was sought.

In the fifth step, the reviewed literature was collated, summarised and reported. Results were structured

thematically along the three dimensions of health, namely physical, mental and social well-being. Based on the results from all five steps we developed a heuristic framework (see Fig. 1). This framework was derived from the data and underwent a communicative, consensual validation process (Bauer and Gaskell 2000; Kvale 1995; Lamnek 2005; Steinke 2003) with external experts working in the area of landscape and health. Figure 1 illustrates the different ways landscape might promote mental, physical, and social well-being and might be used as heuristic device in future studies.

Results

The following section presents an overview on studies that illustrate the mechanisms through which landscape serves as a resource for people's health-promoting activities. The results are divided into three subsections each focusing on mental, physical, and social well-being.

Mental well-being: landscape as a restorative

In their book 'The experience of nature: a psychological perspective', Kaplan and Kaplan (1989) laid the theoretical foundation for explaining landscape's potential influence on cognitive attention restoration. They established four characteristics for restorative environments (Kaplan and Kaplan 1989; Kaplan 1995a, b). First, restorative environments enable people to get some distance from their daily life. Second, they attract people's attention without being exhausting. Third, they enable constant discovery of new things, mostly compatible with already existing information about the environment. Fourth, they are in line with the intentions of their users, i.e. the environment enables the users to do what they want to do. Herzog et al. (1997) added that these kinds of environments contribute to attention restoration in terms of clarifying and ordering thoughts and of reflecting on personal goals and vital matters.

Other studies included in our review have highlighted the fact that a natural landscape is more restorative than an urban one. Hartig et al. (2003) showed that walks in natural landscapes have a stronger effect on the ability to concentrate than urban walks. This goes with other studies that emphasised that people prefer natural landscape such as beaches, waters, forests, parks, and mountains for recovery from mental fatigue (Korpela and Hartig 1996; Korpela et al. 2001; Staats et al. 2003; Staats and Hartig 2004). Furthermore, as the literature suggests, public open spaces used for public entertainment and sports have an intermediate restorative effect in contrast to natural settings, which have a high restorative potential, or urban settings, which

Table 2 Overview of the literature on the health-promoting influence of landscape

Health dimension	Health-promoting landscape effect	Landscape characteristics	Study design	Author(s)
Mental well-being	Attention restoration and recovery from mental fatigue	Natural landscapes such as beaches, waters, forests, parks, mountains	Conceptual accounts/literature reviews	Health Council of the Netherlands (2004); Frumkin (2003, 2001); Kaplan (1995a, b); Kaplan and Kaplan (1989); Maller et al. (2006)
		Availability of public open spaces used for public entertainment and sports	Survey-studies (cross-sectional studies, longitudinal studies)	Herzog et al. (1997); Korpela and Hartig (1996); Korpela et al. (2001); Tennesen and Cinprich (1995)
	Recovery from stress	Experimental studies	Experimental studies	Berto (2005); Hartig et al. (1996, 2003); Kuo (2001); Staats and Hartig (2004); Staats et al. (2003)
		Landscape perceived as pleasant, i.e. landscape contains visual stimuli such as moderate complexity and richness of natural elements like waters or vegetation	Conceptual accounts/literature reviews	Frumkin (2001); Health Council of the Netherlands (2004); Maller et al. (2006)
Physical well-being	Positive emotions	Survey-studies (cross-sectional studies, longitudinal studies)	Survey-studies (cross-sectional studies, longitudinal studies)	Gidlöf-Gunnarsson and Öhrström (2007)
		Easy access to green areas with lower sound levels from road traffic	Experimental studies	Hartig et al. (1996, 1999, 2003); Laumann et al. (2003); Parsons et al. (1998); Ulrich et al. (1991, 2003)
		Landscape perceived as pleasant	Survey-studies (cross-sectional studies, longitudinal studies)	Herzog and Chernick (2000); Kaplan (2001); Korpela et al. (2002); Kuo and Sullivan (2001b); Kuo et al. (1998)
		Open and accessible forests	Experimental studies	Cackowski and Nasar (2003); Kuo and Sullivan (2001a); Staats et al. (1997)
Physical outdoor activity in cities	Physical outdoor activity in cities	Perceived amount of open space and vegetation (urban landscapes)	Qualitative studies	Milligan and Bingley (2007)
		Daily life:	Conceptual accounts/literature reviews	Frank and Engelke (2001); French et al. (2001); Frumkin (2003); Frumkin et al. (2004); Health Council of the Netherlands (2004); Kaspar and Bühler (2006); McCormack et al. (2004); Pikora et al. (2003); Popkin et al. (2005); Powell (2005); Sallis and Glanz (2006)
		Access to and presence of physical activity-promoting facilities	Survey-studies (cross-sectional studies, longitudinal studies)	Addy et al. (2004); Ball et al. (2001); Booth et al. (2000); Cervero and Duncan (2003); Craig et al. (2002); Giles-Corti and Donovan (2002); Gordon-Larsen et al. (2006); Humpel et al. (2004a, b); Lee et al. (2001); Leslie et al. (2005); Li et al. (2005); Neff et al. (2000); Ozgumer and Kendle (2006); Payne et al. (2002); Pikora et al. (2006); Saelens et al. (2003); Titze et al. (2005); Wendel-Vos et al. (2004)
		General functionality of urban districts (e.g., sidewalks, traffic regulation, bicycle and walking paths)	Qualitative studies	Coen and Ross (2006); Eyler et al. (1998); Wilbur et al. (2002)
Physical outdoor activity outside cities	Physical outdoor activity outside cities	Leisure time:	Conceptual accounts/literature reviews	Gasser and Kaufmann-Hayoz (2004)
		Land-use-mix	Survey-studies (cross-sectional studies, longitudinal studies)	Baur and Gilgen (1999); Swiss Federal Office for the Environment (1999); Lamprecht and Stamm (2002); Marti et al. (2002); Pretty et al. (2005a)
		Street connectivity	Experimental studies	Pretty et al. (2005b)
		Traffic safety (e.g. pedestrian zones)	Conceptual accounts/literature reviews	
Physical outdoor activity outside cities	Physical outdoor activity outside cities	Aesthetically appealing landscapes	Survey-studies (cross-sectional studies, longitudinal studies)	
		Trust in neighbours, active neighbours	Experimental studies	
		Nearby parks, playgrounds and sport fields	Experimental studies	
		Access to places for physical activities	Conceptual accounts/literature reviews	
Physical outdoor activity outside cities	Physical outdoor activity outside cities	Aesthetically appealing rural green landscapes (e.g. forests)	Survey-studies (cross-sectional studies, longitudinal studies)	
			Experimental studies	

Table 2 continued

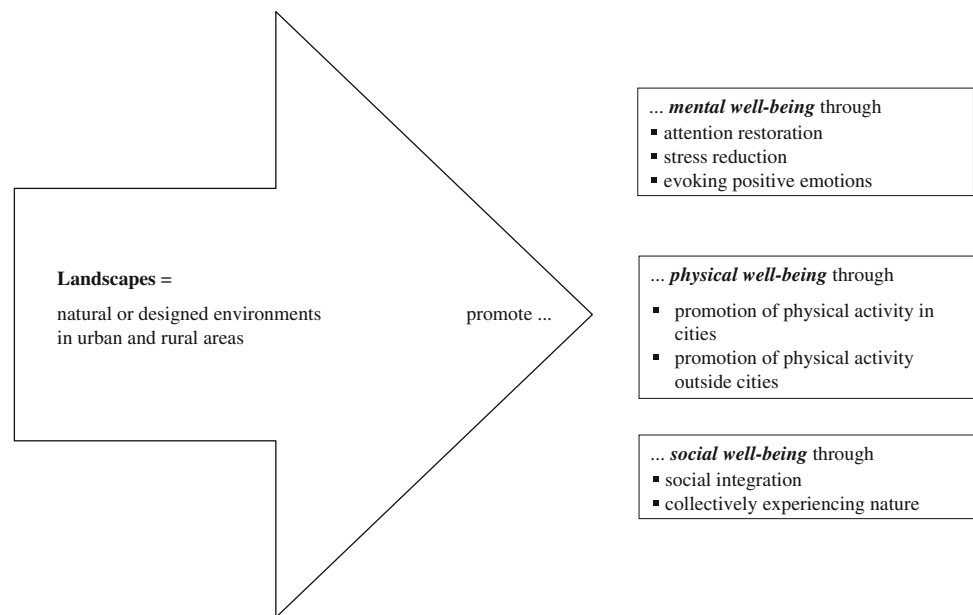
Health dimension	Health-promoting landscape effect	Landscape characteristics	Study design	Author(s)
Social well-being	Social integration	Parks Community gardens Sufficient level of safety, attractive, walkable, serve multiple purposes Rich in vegetation	Conceptual accounts/literature reviews	Brown and Jameon (2000); Frumkin (2003); Frumkin et al. (2004); Hancock (2001); Health Council of the Netherlands (2004); Maller et al. (2006); Twiss et al. (2003);
			Survey-studies (cross-sectional studies, longitudinal studies)	Armstrong (2000); Booth et al. (2000); Coley et al. (1997); Kuo et al. (1998); Kweon et al. (1998); Leyden (2003); Seeland and Ballestros (2004); Stigsdotter and Grahn (2004); Sullivan et al. (2004); Waliczek et al. (2005)
Collectively experiencing nature			Experimental studies	Doyle and Krasny (2003)
			Qualitative studies	Baum and Palmer (2002); Irvine et al. (1999); Milligan et al. (2004); Rishbeth and Finney (2006); Wakefield et al. (2007)
			Survey-studies (cross-sectional studies, longitudinal studies)	Ewert (1991)
			Experimental studies Qualitative studies	Staats and Hartig (2004) Fredrickson and Anderson (1999); Pohl et al. (2000); Sharpe (2005)

have a low restorative potential (Herzog et al. 1997). The restorative potential of natural landscapes was also demonstrated in an experimental study by Berto (2005), in which visual confrontation with pictures of natural landscapes had a restorative effect on mental fatigue in students. Such results are in line with findings of two earlier studies, which measured the effect of a view of a landscape on concentration (Kuo 2001; Tennessen and Cimprich 1995). Our scoping study also reveals the importance of low sound levels for rest and relaxation: Gidlöf-Gunnarsson and Öhrström (2007) point out that people who have easy access to green areas, can reduce noise annoyances and thus become more relaxed.

Parallel to studies on the restorative impact on mental fatigue, other studies included in our review have demonstrated a similar effect when it comes to stress reduction. Ulrich et al. (1991) showed that when people look at a natural landscape, immediate, unconsciously released emotional reactions significantly affect their stress recovery. These effects concern their attention, conscious mental processing, behaviour and physiological reactions. While looking at a landscape that is perceived as pleasant, negative feelings and thoughts—which were previously induced by negative stress exposure—are replaced by positive feelings such as interest, cheerfulness and calmness (Hartig et al. 1996). As the literature shows, this reaction takes place when the landscape contains particular visual stimuli such as a moderate complexity and richness of natural elements like waters or vegetation (Hartig et al. 1996). Indicators for a positive effect are lower physiological excitation in terms of lower pulse rates and lower emotional arousal (Laumann et al. 2003; Parsons et al. 1998; Ulrich et al. 1991, 2003). However, reviewed studies assume a difference between the effects of natural and urban landscapes: Hartig et al. (2003) pointed out that study participants taking a walk in the woods yielded lower emotional and physical stress levels when compared to those taking an urban walk.

Some studies in our review indicate that views of a natural landscape promote people's ability to express positive feelings like joy and satisfaction more easily (Hartig et al. 1999; Kaplan 2001; Korpela et al. 2002). More specifically, open and accessible forests are suggested to enhance positive emotions more than dense and less accessible forests (Milligan and Bingley 2007; Staats et al. 1997). With respect to the positive impact of landscape on general mood, Cackowski and Nasar (2003) showed that a pleasant landscape contributes to higher frustration tolerance, whereas other authors found that lower crime rates and feelings of safety in cities are associated with constructional conditions (e.g. the perceived amount of open space, level of vegetation) (Herzog and Chernick 2000; Kuo et al. 1998; Kuo and Sullivan 2001a, b).

Fig. 1 Heuristic framework on the health-promoting impact of landscape



Physical well-being: walkable landscape

The literature reveals that the way the urban landscape and environment is designed and built is crucial for the level of physical activity in daily life, work and leisure time (Frumkin et al. 2004; Humpel et al. 2004a, b; McCormack et al. 2004; Powell 2005). Pikora et al. (2003, 2005) considered access to destinations, the presence of physical activity-promoting facilities, and the general functionality of urban districts (e.g. sidewalks, traffic regulation) as aspects of landscape that promote and enable physical activity. Further, constructional conditions are bicycle and walking paths for better walkability (Cervero and Duncan 2003; Craig et al. 2002; Frank and Engelke 2001; Li et al. 2005), land-use-mix, street connectivity, traffic safety (e.g. pedestrian zones), and an aesthetically appealing landscape (French et al. 2001; Humpel et al. 2004a, b; Leslie et al. 2005; Saelens et al. 2003; Titze et al. 2005). In terms of physical activity in leisure time, our review illustrates that location and infrastructure, e.g. of a park, safety aspects, and the absence of traffic, play an essential role (Ball et al. 2001; Booth et al. 2000; Neff et al. 2000). Addy et al. (2004) found that people gain additional motivation for regular physical activity when they trust their neighbours, when they perceive their neighbours as active, and when they have the opportunity to use nearby parks, playgrounds and sport fields.

As for social differentiation, studies have indicated that the preferences and needs related to places as well as the access to places for physical activity vary according to gender, age and ethnic background (Eyler et al. 1998; Kaspar and Bühler 2006; Lee et al. 2001; Payne et al. 2002; Wilbur et al. 2002). Authors have emphasised the

importance of providing basic constructional conditions to make spaces for health-promoting physical activities as user friendly as possible (Giles-Corti and Donovan 2002; Wendel-Vos et al. 2004). However, recent studies have clearly shown that many city dwellers in socially deprived areas lack access to places for physical activity (Coen and Ross 2006; Gordon-Larsen et al. 2006; Popkin et al. 2005).

As many studies in our review have illustrated, forests play an important role when it comes to outdoor physical activity outside cities, including walking, hiking, kayaking, and fishing. People use forests for physical activity mainly to recreate and exercise (Baur and Gilgen 1999; Gasser and Kaufmann-Hayoz 2004; Lamprecht and Stamm 2002; Marti et al. 2002; Pretty et al. 2005a, b; Swiss Federal Office for the Environment 1999). In order to be perceived as an option for physical activity, rural green landscapes must be aesthetically appealing to their users (Pretty et al. 2005a, b).

Social well-being: landscape as a bonding structure

According to Armstrong (2000) and Leyden (2003), urban parks and other public places can enhance social integration if they facilitate social contacts, exchange, collective work, community building, empowerment, social networks and mutual trust. Also, socially integrative functions of landscape were found in studies with elderly people (Booth et al. 2000; Kweon et al. 1998; Milligan et al. 2004) and migrants (Rishbeth and Finney 2006; Seeland and Ballesteros 2004). As the literature suggests, urban landscape should provide a sufficient level of safety (e.g. park controls), attractiveness, walkability, should serve multiple

purposes (Baum and Palmer 2002; Leyden 2003) and be rich in vegetation (Coley et al. 1997; Kuo et al. 1998; Sullivan et al. 2004) to promote social integration.

In a recent article the health-promoting impact of community gardening was addressed: Among other benefits, community gardening was found to foster the development of community networks, social support and to motivate people for community engagement (Wakefield et al. 2007). With their results the authors complemented findings from earlier studies about the health benefits of community and private gardens (Armstrong 2000; Brown and Jameton 2000; Doyle and Krasny 2003; Hancock 2001; Irvine et al. 1999; Stigsdotter and Grahn 2004; Twiss et al. 2003; Waliczek et al. 2005).

As our scoping study illustrates, collective nature experience programmes have become popular in the fields of education, management and psychology over the last 20 years. The collective experience of nature in non-urban areas has been linked to various aspects of health: '[...] wilderness experiences may be salutary because of the benefits of companionship, being physically active, taking a vacation, or meeting a challenge, and not because of nature contact per se' (Frumkin 2003). Besides individual outcomes, (Fredrickson and Anderson 1999; Pohl et al. 2000), many of these programmes concentrate on the collective experience of group dynamics. As we found in the literature, such programmes provide experience of equality and community (Sharpe 2005), social decision-making and responsibility, social bonding and support (Fredrickson and Anderson 1999; Pohl et al. 2000), and feelings of being protected (Staats and Hartig 2004). They further facilitate the building of integrative groups, collective solving of spontaneously emerging problems and collective landscape planning and design (Ewert 1991).

Discussion

In the field of health promotion, landscape should be understood to be a multi-faceted resource for physical, mental and social health and well-being. This is the general conclusion that can be drawn from the findings of the present study. More specifically however, a synthesis of the results provides the first answers to the specific questions raised at the beginning of this paper:

How can landscape promote health?

Landscape might function as a spatial framework for health-promoting activities in physical, mental, and social realms. These activities are linked to health outcomes and improvements such as:

- attention restoration,
- stress recovery,
- evocation of positive emotions,
- physical outdoor activities in and outside cities,
- social integration,
- collective experience of nature.

How should landscape look like to promote people's health?

In order to promote health, landscapes need to have certain characteristics that influence human well-being directly or indirectly (see Table 2), and which turn them into "good places" for health (Frumkin 2003). Most important among these are easy access to natural landscapes and the availability of nearby (green) public open spaces. Landscapes need to be perceived as pleasant and attractive for all senses, and safe in terms of well-lit streets, presence of other people and sidewalks, which make people feel safe from crime and traffic dangers. Furthermore, neighbourhoods need to provide a general functionality (e.g. street connectivity, pedestrian zones, bicycle tracks) to promote walkability: A walking-friendly design enables independence from automobiles and promotes healthy physical behaviour through easy access. Landscapes also foster healthy behaviour and emotional well-being if they offer the possibility of meeting and engaging with other people in public open spaces.

Who might benefit from a health-promoting landscape?

Many of the studies reviewed emphasised that landscape should promote everyone's health in daily life, suggesting that all people should have access to health-promoting landscapes at home, at work, and during leisure time. This demand is clearly supported by the Ottawa-Charter's call to create supportive environments for everyone (WHO 1986). However, there are apparent challenges to this: people's landscape preferences, needs, and uses are socially and culturally diverse. As documented in this review, health-promoting landscapes are perceived and used differently by various social groups and are therefore a group-specific matter. Moreover, not everybody has equal access to health-promoting landscapes. Thus, unequal access may function as a way in which inequalities in the distribution of resources contribute to the (re-)production of health inequalities. To cite just one case in point: socially deprived people, who do not have access to safe outdoor spaces for physical activity, are likely to suffer more often from obesity than people with access to such spaces (Gordon-Larsen et al. 2006; Popkin et al. 2005). And in contrast, people who live in a safe neighbourhood, which

provides a certain number of sport fields and which enables children to walk to school or go there by bike, are physically more active than other people (Sallis and Glanz 2006).

From a health-promoting perspective, our findings provide strong additional and new support for understanding landscapes as a health resource and health determinant (Frumkin 2003; Maller et al. 2006). According to the results of the present scoping study, the relationship between landscape and health shows two main features: first, health-promoting landscapes contribute to healthy lifestyles in terms of physical activity and mental and emotional relaxation. Second, health-promoting landscapes promote the acquisition of resources for health such as social support, concentration and emotional stability. Beyond these findings, the study provides an up-to-date overview of the current literature and a new framework as a heuristic tool. As such it may be useful for future research and practice to systematically explore and foster the health-promoting impact of landscape on mental, physical and social well-being. Disciplines dealing with the relation between landscape and health differ widely in terms of terminology, methodologies, aims and scopes. The framework proposed in this paper, may also serve as a starting point for interdisciplinary discourses geared to reach a common ground for explorations into the links between landscapes and health.

However, while current evidence of landscape as a health resource is considerable this evidence remains scattered. More research in this field is called to better understand the health-promoting impacts of different landscape characteristics. Future studies should address issues concerning variations in landscape needs in different social groups. To better understand the user needs, more participatively designed studies and interventions are needed (Buchecker et al. 2003; Takano and Nakamura 2004). As shown in Table 2, till date cross-sectional or experimental study designs make up the vast majority of research. The problem is, however, that they largely fail to grasp socially differentiated meanings of landscape. Thus, in terms of methodology, there is a need for more elaborate and diverse study designs such as qualitative studies, longitudinal analyses or cross-over studies. Furthermore, when it comes to health promotion and the social distribution of health resources, future studies should investigate the issues around access to health-promoting landscapes by different social groups. Such research should not be limited to descriptions of the presence or absence of health-promoting landscape resources in socially deprived areas. Much broader studies are needed that investigate the quality of health-promoting landscape resources, their social meaning and people's perception of their accessibility and relevance (Macintyre 2007). Finally, there is also

a need to sharpen current landscape definitions, and to take into account that landscape is perceived with all senses. Literature on "soundscapes" (Adams et al. 2006; Atkinson 2007; Carles et al. 1999; Ge and Hokao 2005; Gidlöf-Gunnarsson and Öhrström 2007; O'Connor 2008; Raimbault and Dubois 2005; Yang and Kang 2005) and "smellscapes" (Porteous 1990) call attention to this multisensory conceptualisation of landscape. Comprehensive definitions of landscape which include multi-sensory aspects of perception are important also in terms of empirical operationalisation of concepts, the evaluation of their validity and comparability of study results.

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